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(51)Int.Cl.

C08L 77/06**C08K 3/00**(21)Application number : **07-064061**(71)Applicant : **MITSUBISHI GAS CHEM CO INC**(22)Date of filing : **23.03.1995**(72)Inventor : **INABA YASUO
HARADA MASAHIRO
MORIMOTO KAORU
WATANABE NORIYOSHI****(54) POLYAMIDE RESIN COMPOSITION**

(57)Abstract:

PURPOSE: To obtain a polyamide resin composition for molding having high strength and modulus capable of substituting a metal and excellent in formability.

CONSTITUTION: This composition is obtained by compounding a crystalline copolymer and an inorganic filler. The crystalline copolymer is obtained by the polycondensation of a mixed xylylenediamine, which is composed of 25-65mol% of p-xylylenediamine and 75-35mol% of m-xylylenediamine, with an α , ω -straight chain aliphatic dicarboxylic acid having the number of carbons of 6-12. In the copolymer, the difference between a melting point and a crystallization temperature determined by DSC method is $\leq 60^{\circ}\text{C}$.

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CLAIMS

[Claim(s)]

[Claim 1] The polyamide resin constituent which consists of the melting point measured by the DSC method and the crystalline copolymerization polyamide whose difference of crystallization temperature is 60 degrees C or less which were obtained from the polycondensation reaction of the mixed KISHIRI range amine which consists of 25-65 mol % of PARAKI silylene diamines, and 75-35 mol % of meta key silylene diamines, and carbon numbers 6-12alpha and omega-straight chain aliphatic dicarboxylic acid, and inorganic packing.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the polyamide resin constituent for fabrication which has the high intensity in which a metal alternative is possible, and a rate of high elasticity, and has a still better moldability.

[0002]

[Description of the Prior Art] The polyamide resin represented by nylon 6 and Nylon 66 is excellent in toughness, chemicals-proof nature, the electrical property, etc., and is widely used for autoparts, a machine part, electrical-and-electric-equipment parts, etc. as a molding material. In it, compared with conventional polyamide resin, it has the feature of high intensity, a high elastic modulus, and low absorptivity, use to the electrical-and-electric-equipment parts and autoparts of which lightweight and a miniaturization are required progresses as metal alternate material, and the polyamide (it may be hereafter called nylon MXD6) obtained from the meta key silylene diamine and the adipic acid has the remarkable increase in the need in recent years.

[0003] The crystallization speed of nylon MXD6 is slow as compared with nylon 6 or Nylon 66. so, nylon MXD6 -- if independent -- the time of injection molding -- metal mold -- it is hard to crystallize inside, and light-gage fabrication is difficult or it is easy to generate problems obtained, such as deformation of mold goods and a fall of a mechanical strength. Therefore, in order to use nylon MXD6 as a molding material, it is necessary for Nylon 66 and the talc powder which are high crystallization speed to be blended, and to increase crystallization speed, or to make a die temperature high, and to improve a moldability (JP, 54-32458, B). However, in order to blend Nylon 66, compared with a case independent [nylon MXD6], a water absorption is large, and so, the fall of the mechanical strength by water absorption is accepted.

[0004]

[Problem(s) to be Solved by the Invention] In order that this invention may solve the above-mentioned trouble which nylon MXD6 has, in the main raw material of a polyamide as a diamine component By obtaining the copolymerization polyamide of high crystallization speed and blending an inorganic filler with this copolymerization polyamide, using an adipic acid as the mixture of a meta key silylene diamine and a PARAKI silylene diamine, and a dicarboxylic-acid component It aims at an effect being in low temperature-ization of a good moldability, especially the degree of shortening metallurgy mold temperature of the cycle time of fabrication, or offering the polyamide molding material suitable for light-gage fabrication.

[0005]

[Means for Solving the Problem] Wholeheartedly, as a result of examination, the polyamide resin constituent using the copolymerization polyamide obtained from specific monomer composition has a large crystallization speed, has a good moldability, and finds out that an effect is in shortening of the cycle time of fabrication further, and this invention persons came to complete this invention.

[0006] That is, this invention relates to the polyamide resin constituent which consists of the melting point measured by the DSC method and the crystalline copolymerization polyamide whose difference of crystallization temperature is 60 degrees C or less which were obtained from the polycondensation reaction of the mixed xylylene diamine which consists of 25-65 mol % of PARAKI silylene diamines, and 75-35 mol % of meta-xylylene diamines, and carbon numbers 6-12 alpha and omega-straight chain aliphatic dicarboxylic acid, and inorganic packing.

[0007] JIS-7121 are used with the DSC method in this invention. The crystallization speed of polymer tends to become large, so that the difference of the melting point generally measured by the DSC method and crystallization temperature is small. Therefore, when the difference of the melting point and crystallization temperature exceeds 60 degrees C, it is the polyamide which does not have sufficient degree of crystallization profit in many cases, and in the fabrication using such a polyamide, low temperature-ization of the degree of shortening metallurgy mold temperature of the cycle time etc. becomes difficult.

[0008] The diamine which is the monomer of the **** copolymerization polyamide for this inventions It is the mixed xylylene diamine to contain. 75-35 mol % of 25-65 mol % and meta-xylylene diamines of PARAKI silylene diamines -- By request, further An aliphatic diamine, for example, a tetramethylenediamine, a pentamethylene diamine, A hexamethylenediamine, an octamethylene diamine, a nonamethylene diamine, etc., An aromatic diamine, for example, a meta-phenylenediamine, a p phenylenediamine, etc., Furthermore, out of alicycle group diamine, 1 [for example,], 3-screw aminomethyl cyclohexane, 1, and 4-screw aminomethyl cyclohexane etc., in the range which does not exceed five-mol% of all diamines, more than a kind can be chosen suitably and it can be used.

[0009] The crystallization speed of the copolymerization polyamide from which the PARAKI silylene diamine content of a mixed KISHIRI range amine is obtained less than [25 mol %] will be small, and the difference of the melting point and crystallization temperature will exceed 60 degrees C. This causes the fall of deformation by aggravation of a moldability, and poor crystallization of mold goods, or a mechanical strength. When the PARAKI silylene diamine content in a diamine component exceeds 65-mol %, the melting point of the copolymerization polyamide resin obtained approaches 300 degrees C, and becomes easy to cause the heat deterioration by heating at the time of fabrication, and fabrication becomes moreover, less easy.

[0010] It is an adipic acid preferably and the dicarboxylic acid which is the monomer of the copolymerization polyamide used by this invention may be suitably chosen according to a request in alpha whose carbon numbers are 6-12, an omega-aliphatic dicarboxylic acid, and the range which does not exceed five-mol% of all dicarboxylic acids more than in a kind out of an aliphatic dicarboxylic acid, for example, a succinic acid, a glutaric acid, a pimelic acid, a suberic acid, an azelaic acid, a sebacic acid, undecane diacid, dodecane diacid, etc. aromatic dicarboxylic-acid, 1, and 5-naphthalene When the melt viscosity at the time of fabrication and the mechanical property intensity after fabrication are taken into consideration, as for the relative viscosity (96% sulfuric-acid solution 1g/100mL) of the copolymerization polyamide used by this invention, it is desirable that it is 1.5-4.0.

[0011] It is not necessary to blend Nylon 66 blended by the molding material using conventional nylon MXD6 in this invention. By not blending Nylon 66, a water absorption can fall and deterioration of the mechanical property by water absorption can be prevented.

[0012] If inorganic packing used by this invention is used for this kind of a general constituent, there is especially no limit and it can use powder, fibrous, and the thing that used together inorganic packing of the shape of granular and flakes, or these. When a mechanical performance etc. is taken into consideration, as for the blending ratio of coal of inorganic packing, it is desirable that it is the 10 - 150 weight section to the copolymerization polyamide 100 weight section.

[0013] As fibrous packing, the whisker of a glass fiber, a potassium titanate, or a calcium sulfate, a carbon fiber, an alumina fiber, etc. can be used. As powdered packing, preferably, it has the particle size of 80 micrometers or less still more preferably, and 100 micrometers or less of sulfates, such as carbonates, such as a kaolinite, a silica, a calcium carbonate, and a magnesium carbonate, a calcium sulfate, and magnesium sulfate, sulfides, metallic oxides, etc. can be used.

[0014] In order to promote crystallization further in this invention, it is desirable to use talc powder. Preferably, 100 micrometers or less, the talc to be used has the particle size of 80 micrometers or less still more preferably, and is blended at a rate below 30 weight sections to the copolymerization polyamide 100 weight section. If the blending ratio of coal of talc exceeds 30 weight sections to the copolymerization polyamide 100 weight section, since the evil of the fluid fall of the resin at the time of fabrication and the mechanical performance of mold goods obtained falling will be caused, it is not desirable.

[0015] In addition, a stabilizer, a coloring agent, etc. to one or more sorts of additives, for example, a flame retarder, an antistatic agent, lubricant, a plasticizer, oxidation, or degradation by heat and ultraviolet rays can be used if needed.

[0016]

[Effect of the Invention] By using the copolymerization polyamide of this invention, by the molding material using conventional nylon MXD6, difficult light-gage fabrication was made easy and moldabilities, such as low-temperature-izing of the degree of shortening metallurgy mold temperature of a molding cycle, have been improved further. Furthermore, deterioration of the mechanical property by water absorption was suppressed.

[0017]

[Example] Hereafter, although an example explains this invention, this invention is not limited to these examples. In addition, among an example, especially, as long as there is no notice, the "section" expresses the weight section. The process condition of an example 1 is as being shown below.

[0018]

Cylinder temperature 280-degree-C die temperature 130-degree-C injection pressure The process condition of 1000 kg/cm2 example 2 is as being shown below.

Cylinder temperature 290-degree-C die temperature 130-degree-C injection pressure The process condition of the example 1 of 1000 kg/cm2 comparison is as being shown below.

Cylinder temperature 270-degree-C die temperature 130-degree-C injection pressure 1000 kg/cm2. [0019] Evaluation was based on the following methods.

(1) Transition temperature : JIS K7121 (however, moisture content of a measurement sample was made into 0.1 or less % of the weight.)

(2) Specific gravity : ASTM D792 (3) tension test: ASTM D638 (4) bending test: ASTM D790 (5) water absorption test: ASTM D570 (underwater, 24 hours)

(6) semi-crystallization time: -- a ***** on-the-strength method and a use device -- KOTAKI Factory polymer crystallization speed measuring device MK-701 type, the melting temperature of 280 degrees C (example 1), 290 degrees C (example 2), 270 degrees C (example 1 of comparison), melting time 3 minutes, the degree of crystallization bath temperature of 130 degrees C, and a sample configuration -- a pellet

[0020] Heating melting of the example 1 adipic acid was carried out within the reaction can of nitrogen atmosphere. the melting dicarboxylic acid -- a PARAKI silylene diamine -- a 30-mol % and meta key silylene diamine -- 70-mol % -- the mixed KISHIRI range amine to contain was dropped serially, and it stirred, maintaining reaction temperature so that it may always exceed the melting point of a product After the dropping end, when stirring and the reaction were continued and attained until it reached predetermined viscosity, from the reaction can, water cooling of the product was discharged and carried out, and it was pelletized.

The obtained copolymerization polyamide is described as "Polyamide A" below. The melting point of Polyamide A was 206 degrees C in 258 degrees C and crystallization temperature, and relative viscosity (96% sulfuric-acid solution 1g/100mL) was 2.08.

[0021] After blending the talc 4 section and the glass fiber 100 section and carrying out melting kneading at 280 degrees C of cylinder temperatures to the polyamide A100 section compounded on the above-mentioned conditions using a vent formula single screw extruder (product made from NAKATANI Machine), water cooling was carried out and it pelletized. The test piece for tension tests, the test piece for bending tests, and the test piece for water absorption tests were fabricated with the injection molding machine using the obtained resin constituent. An evaluation result is shown in Table 1.

[0022] Heating melting of the example 2 adipic acid was carried out within the reaction can of nitrogen atmosphere. the melting dicarboxylic acid -- a PARAKI silylene diamine -- a 50-mol % and meta key silylene diamine -- 50-mol % -- the mixed KISHIRI range amine and meta key silylene diamine to contain were divided into two stages, and were serially dropped so that it might finally become PARAKI silylene diamine 40 mol % and meta key silylene diamine 60 mol %, and it stirred, maintaining reaction temperature so that it may always exceed the melting point of a product After the dropping end, when stirring and the reaction were continued and attained until it reached predetermined viscosity, from the reaction can, water cooling of the product was discharged and carried out, and it was pelletized. The obtained copolymerization polyamide is described as "Polyamide B" below. The melting point of Polyamide B was 227 degrees C in 269 degrees C and crystallization temperature, and relative viscosity (96% sulfuric-acid solution 1g/100mL) was 2.13.

[0023] After blending the talc 4 section and the glass fiber 100 section and carrying out melting kneading at 290 degrees C of cylinder temperatures to the polyamide B100 section compounded on the above-mentioned conditions using a vent formula single screw extruder (product made from NAKATANI Machine), water cooling was carried out and it pelletized. The test piece for tension tests, the test piece for bending tests, and the test piece for water absorption tests were fabricated with the injection molding machine using the obtained resin constituent. An evaluation result is shown in Table 1.

[0024] After blending the Nylon 66 (Toray Industries, Inc. make) 10 section, the talc 4 section, and the glass fiber 100 section and carrying out melting kneading at 270 degrees C of cylinder temperatures using a vent formula single screw extruder (product made from NAKATANI Machine) to the example of comparison 1 nylon MXD6 (Mitsubishi Gas Chemical Co., Inc. make, melting point [of 237 degrees C], crystallization temperature [of 152 degrees C], relative viscosity 2.10) 90 section, water cooling was carried out and it pelletized. The test piece for tension tests, the test piece for bending tests, and the test piece for water absorption tests were fabricated with the injection molding machine using the obtained resin constituent. An evaluation result is shown in Table 1.

[0025] The semi-crystallization time of an example 1 and an example 2 is shorter than the example 1 of comparison, and it was admitted that crystallization speed was increasing. Moreover, compared with the example 1 of comparison of the conventional technology, the mechanical property of an example 1 and an example 2 is equivalent. The water absorption of an example 1 and an example 2 is lower than the example 1 of comparison.

[0026] Table [] 1. An example 1 An example 2 Example 1 of comparison Polyamide resin A B MXD6 (**) Melting point (degree C) 258 269 237 (**) Crystallization temperature (degree C) 206 227 152 (**) (**) Difference (degree C) 52 4285 The blending ratio of coal of a component (weight section)

Above-mentioned polyamide resin 100. 100 90 Nylon 66 0 0 10 A glass fiber 100 100 100 Talc 4 4 4 Semi-crystallization time (Second) 2.9 2.5 6.0 Specific gravity 1.65 1.65 1.65 Tensile strength (MPa) 282 255 273 A modulus of elasticity in tension (GPa) 2019 20 **** pace of expansion (%) 2.01.9 2.1 bending strength (MPa) 359 329 364
 Bending elastic modulus (GPa) 1717 18 Water absorption (%) 0.10 0.10 0.13

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TECHNICAL FIELD

[Industrial Application] this invention relates to the polyamide resin constituent for fabrication which has the high intensity in which a metal alternative is possible, and a rate of high elasticity, and has a still better moldability.

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PRIOR ART

[Description of the Prior Art] The polyamide resin represented by nylon 6 and Nylon 66 is excellent in toughness, chemicals-proof nature, the electrical property, etc., and is widely used for autoparts, a machine part, electrical-and-electric-equipment parts, etc. as a molding material. In it, compared with conventional polyamide resin, it has the feature of high intensity, a high elastic modulus, and low absorptivity, use to the electrical-and-electric-equipment parts and autoparts of which lightweight and a miniaturization are required progresses as metal alternate material, and the polyamide (it may be hereafter called nylon MXD6) obtained from the meta key silylene diamine and the adipic acid has the remarkable increase in the need in recent years.

[0003] The crystallization speed of nylon MXD6 is slow as compared with nylon 6 or Nylon 66. so, nylon MXD6 -- if independent -- the time of injection molding -- metal mold -- it is hard to crystallize inside, and light-gage fabrication is difficult or it is easy to generate problems obtained, such as deformation of mold goods and a fall of a mechanical strength Therefore, in order to use nylon MXD6 as a molding material, it is necessary for Nylon 66 and the talc powder which are high crystallization speed to be blended, and to increase crystallization speed, or to make a die temperature high, and to improve a moldability (JP,54-32458,B). However, in order to blend Nylon 66, compared with a case independent [nylon MXD6], a water absorption is large, and so, the fall of the mechanical strength by water absorption is accepted.

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EFFECT OF THE INVENTION

[Effect of the Invention] By using the copolymerization polyamide of this invention, by the molding material using conventional nylon MXD6, difficult light-gage fabrication was made easy and moldabilities, such as low-temperature-izing of the degree of shortening metallurgy mold temperature of a molding cycle, have been improved further. Furthermore, deterioration of the mechanical property by water absorption was suppressed.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In order that this invention may solve the above-mentioned trouble which nylon MXD6 has, in the main raw material of a polyamide as a diamine component By obtaining the copolymerization polyamide of high crystallization speed and blending an inorganic filler with this copolymerization polyamide, using an adipic acid as the mixture of a meta key silylene diamine and a PARAKI silylene diamine, and a dicarboxylic-acid component It aims at an effect being in low temperature-ization of a good moldability, especially the degree of shortening metallurgy mold temperature of the cycle time of fabrication, or offering the polyamide molding material suitable for light-gage fabrication.

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MEANS

[Means for Solving the Problem] Wholeheartedly, as a result of examination, the polyamide resin constituent using the copolymerization polyamide obtained from specific monomer composition has a large crystallization speed, has a good moldability, and finds out that an effect is in shortening of the cycle time of fabrication further, and this invention persons came to complete this invention.

[0006] That is, this invention relates to the polyamide resin constituent which consists of the melting point measured by the DSC method and the crystalline copolymerization polyamide whose difference of crystallization temperature is 60 degrees C or less which were obtained from the polycondensation reaction of the mixed xylylene diamine which consists of 25-65 mol % of PARAKI silylene diamines, and 75-35 mol % of meta-xylylene diamines, and carbon numbers 6-12 α and ω -straight chain aliphatic dicarboxylic acid, and inorganic packing.

[0007] JIS-7121 are used with the DSC method in this invention. The crystallization speed of polymer tends to become large, so that the difference of the melting point generally measured by the DSC method and crystallization temperature is small. Therefore, when the difference of the melting point and crystallization temperature exceeds 60 degrees C, it is the polyamide which does not have sufficient degree of crystallization profit in many cases, and in the fabrication using such a polyamide, low temperature-ization of the degree of shortening metallurgy mold temperature of the cycle time etc. becomes difficult.

[0008] The diamine which is the monomer of the **** copolymerization polyamide for this inventions It is the mixed KISHIRI range amine to contain. 75-35 mol % of 25-65 mol % and meta key silylene diamines of PARAKI silylene diamines -- By request, further An aliphatic diamine, for example, a tetramethylenediamine, a pentamethylene diamine, A hexamethylenediamine, an octamethylene diamine, a nonamethylene diamine, etc., An aromatic diamine, for example, a meta-phenylenediamine, a p phenylenediamine, etc., Furthermore, out of alicycle group diamine, 1 [for example,], 3-screw aminomethyl cyclohexane, 1, and 4-screw aminomethyl cyclohexane etc., in the range which does not exceed five-mol% of all diamines, more than a kind can be chosen suitably and it can be used.

[0009] The crystallization speed of the copolymerization polyamide from which the PARAKI silylene diamine content of a mixed KISHIRI range amine is obtained less than [25 mol %] will be small, and the difference of the melting point and crystallization temperature will exceed 60 degrees C. This causes the fall of deformation by aggravation of a moldability, and poor crystallization of mold goods, or a mechanical strength. When the PARAKI silylene diamine content in a diamine component exceeds 65-mol %, the melting point of the copolymerization polyamide resin obtained approaches 300 degrees C, and becomes easy to cause the heat deterioration by heating at the time of fabrication, and fabrication becomes moreover, less easy.

[0010] It is an adipic acid preferably and the dicarboxylic acid which is the monomer of the copolymerization polyamide used by this invention may be suitably chosen according to a request in α whose carbon numbers are 6-12, an ω -aliphatic dicarboxylic acid, and the range which does not exceed five-mol% of all dicarboxylic acids more than in a kind out of an aliphatic dicarboxylic acid, for example, a succinic acid, a glutaric acid, a pimelic acid, a suberic acid, an azelaic acid, a sebacic acid, undecane 2 acid, dodecane 2 acid, etc. aromatic dicarboxylic-acid, 1, and 5 When the melt viscosity at the time of fabrication and the mechanical property intensity after fabrication are taken into consideration, as for the relative viscosity (96% sulfuric-acid solution 1g/100mL) of the copolymerization polyamide used by this invention, it is desirable that it is 1.5-4.0.

[0011] It is not necessary to blend Nylon 66 blended by the molding material using conventional nylon MXD6 in this invention. By not blending Nylon 66, a water absorption can fall and deterioration of the mechanical property by water absorption can be prevented.

[0012] If inorganic packing used by this invention is used for this kind of a general constituent, there is especially no limit and it can use powder, fibrous, and the thing that used together inorganic packing of the shape of granular and flakes, or these. When a mechanical performance etc. is taken into consideration, as for the blending ratio of coal of inorganic packing, it is desirable that it is the 10 - 150 weight section to the copolymerization polyamide 100 weight section.

[0013] As fibrous packing, the whisker of a glass fiber, a potassium titanate, or a calcium sulfate, a carbon fiber, an alumina fiber, etc. can be used. As powdered packing, preferably, it has the particle size of 80 micrometers or less still more preferably, and 100 micrometers or less of sulfates, such as carbonates, such as a kaolinite, a silica, a calcium carbonate, and a magnesium carbonate, a calcium sulfate, and magnesium sulfate, sulfides, metallic oxides, etc. can be used.

[0014] In order to promote crystallization further in this invention, it is desirable to use talc powder. Preferably, 100 micrometers or less, the talc to be used has the particle size of 80 micrometers or less still more preferably, and is blended at a rate below 30 weight sections to the copolymerization polyamide 100 weight section. If the blending ratio of coal of talc exceeds 30 weight

sections to the copolymerization polyamide 100 weight section, since the evil of the fluid fall of the resin at the time of fabrication and the mechanical performance of mold goods obtained falling will be caused, it is not desirable.
[0015] In addition, a stabilizer, a coloring agent, etc. to one or more sorts of additives, for example, a flame retarder, an antistatic agent, lubricant, a plasticizer, oxidization, or degradation by heat and ultraviolet rays can be used if needed.

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EXAMPLE

[Example] Hereafter, although an example explains this invention, this invention is not limited to these examples. In addition, among an example, especially, as long as there is no notice, the "section" expresses the weight section. The process condition of an example 1 is as being shown below.

[0018]

Cylinder temperature 280-degree-C die temperature 130-degree-C injection pressure The process condition of 1000 kg/cm² example 2 is as being shown below.

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Cylinder temperature 270-degree-C die temperature 130-degree-C injection pressure 1000 kg/cm². [0019] Evaluation was based on the following methods.

(1) Transition temperature : JIS K7121 (however, moisture content of a measurement sample was made into 0.1 or less % of the weight.)

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(6) semi-crystallization time: -- a ***** on-the-strength method and a use device -- KOTAKI Factory polymer crystallization speed measuring device MK-701 type, the melting temperature of 280 degrees C (example 1), 290 degrees C (example 2), 270 degrees C (example 1 of comparison), melting time 3 minutes, the degree of crystallization bath temperature of 130 degrees C, and a sample configuration -- a pellet

[0020] Heating melting of the example 1 adipic acid was carried out within the reaction can of nitrogen atmosphere. the melting dicarboxylic acid -- a PARAKI silylene diamine -- a 30-mol % and meta key silylene diamine -- 70-mol % -- the mixed KISHIRI range amine to contain was dropped serially, and it stirred, maintaining reaction temperature so that it may always exceed the melting point of a product After the dropping end, when stirring and the reaction were continued and attained until it reached predetermined viscosity, from the reaction can, water cooling of the product was discharged and carried out, and it was pelletized. The obtained copolymerization polyamide is described as "Polyamide A" below. The melting point of Polyamide A was 206 degrees C in 258 degrees C and crystallization temperature, and relative viscosity (96% sulfuric-acid solution 1g/100mL) was 2.08.

[0021] After blending the talc 4 section and the glass fiber 100 section and carrying out melting kneading at 280 degrees C of cylinder temperatures to the polyamide A100 section compounded on the above-mentioned conditions using a vent formula single screw extruder (product made from NAKATANI Machine), water cooling was carried out and it pelletized. The test piece for tension tests, the test piece for bending tests, and the test piece for water absorption tests were fabricated with the injection molding machine using the obtained resin constituent. An evaluation result is shown in Table 1.

[0022] Heating melting of the example 2 adipic acid was carried out within the reaction can of nitrogen atmosphere. the melting dicarboxylic acid -- a PARAKI silylene diamine -- a 50-mol % and meta key silylene diamine -- 50-mol % -- the mixed KISHIRI range amine and meta key silylene diamine to contain were divided into two stages, and were serially dropped so that it might finally become PARAKI silylene diamine 40 mol % and meta key silylene diamine 60 mol %, and it stirred, maintaining reaction temperature so that it may always exceed the melting point of a product After the dropping end, when stirring and the reaction were continued and attained until it reached predetermined viscosity, from the reaction can, water cooling of the product was discharged and carried out, and it was pelletized. The obtained copolymerization polyamide is described as "Polyamide B" below. The melting point of Polyamide B was 227 degrees C in 269 degrees C and crystallization temperature, and relative viscosity (96% sulfuric-acid solution 1g/100mL) was 2.13.

[0023] After blending the talc 4 section and the glass fiber 100 section and carrying out melting kneading at 290 degrees C of cylinder temperatures to the polyamide B100 section compounded on the above-mentioned conditions using a vent formula single screw extruder (product made from NAKATANI Machine), water cooling was carried out and it pelletized. The test piece for tension tests, the test piece for bending tests, and the test piece for water absorption tests were fabricated with the injection molding machine using the obtained resin constituent. An evaluation result is shown in Table 1.

[0024] After blending the Nylon 66 (Toray Industries, Inc. make) 10 section, the talc 4 section, and the glass fiber 100 section and carrying out melting kneading at 270 degrees C of cylinder temperatures using a vent formula single screw extruder (product made from NAKATANI Machine) to the example of comparison 1 nylon MXD6 (Mitsubishi Gas Chemical Co., Inc. make,

melting point [of 237 degrees C], crystallization temperature [of 152 degrees C], relative viscosity 2.10) 90 section, water cooling was carried out and it pelletized. The test piece for tension tests, the test piece for bending tests, and the test piece for water absorption tests were fabricated with the injection molding machine using the obtained resin constituent. An evaluation result is shown in Table 1.

[0025] The semi-crystallization time of an example 1 and an example 2 is shorter than the example 1 of comparison, and it was admitted that crystallization speed was increasing. Moreover, compared with the example 1 of comparison of the conventional technology, the mechanical property of an example 1 and an example 2 is equivalent. The water absorption of an example 1 and an example 2 is lower than the example 1 of comparison.

[0026]

Table [] 1 . An example 1 An example 2 Example 1 of comparison Polyamide resin A B MXD6 (**) Melting point (degree C) 258 269 237 (**) Crystallization temperature (degree C) 206 227 152 (**) (**) Difference (degree C) 52 4285 The blending ratio of coal of a component (weight section)

Above-mentioned polyamide resin 100. 100 90 Nylon 66 0 0 10 A glass fiber 100 100 100 Talc 4 4 4 Semi-crystallization time (Second) 2.9 2.5 6.0 Specific gravity 1.65 1.65 1.65 Tensile strength (MPa) 282 255 273 A modulus of elasticity in tension (GPa) 2019 20 **** pace of expansion (%) 2.01.9 2.1 bending strength (MPa) 359329 364 Bending elastic modulus (GPa) 1717 18 Water absorption (%) 0.10 0.10 0.13 .

[Translation done.]

* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CORRECTION or AMENDMENT

[Official Gazette Type] Printing of the amendment by the convention of 2 of Article 17 of patent law.
[Section partition] The 3rd partition of the 3rd section.
[Date of issue] June 4, Heisei 14 (2002. 6.4)

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[Procedure revision]
[Filing Date] March 5, Heisei 14 (2002. 3.5)
[Procedure amendment 1]
[Document to be Amended] Specification.
[Item(s) to be Amended] 0007.
[Method of Amendment] Change.

[Proposed Amendment]
[0007] JIS-7121 are used with the DSC method in this invention. The crystallization speed of polymer tends to become large, so that the difference of the melting point generally measured by the DSC method and crystallization temperature is small. Therefore, when the difference of the melting point and crystallization temperature exceeds 60 degrees C, it is the polyamide which does not have sufficient crystallization speed in many cases, and in the fabrication using such a polyamide, low temperature-ization of the degree of shortening metallurgy mold temperature of the cycle time etc. becomes difficult.

[Procedure amendment 2]
[Document to be Amended] Specification.
[Item(s) to be Amended] 0010.
[Method of Amendment] Change.
[Proposed Amendment]

[0010] The dicarboxylic acid which is the monomer of the copolymerization polyamide used by this invention, It is an adipic acid preferably and a carbon number may be suitably chosen according to a request in alpha which is 6-12, an omega-aliphatic dicarboxylic acid, and the range which does not exceed five-mol% of all dicarboxylic acids more than in a kind out of an aliphatic dicarboxylic acid, for example, a succinic acid, a glutaric acid, a pimelic acid, a suberic acid, an azelaic acid, a sebacic acid, undecane 2 acid, dodecane 2 acid, etc. aromatic dicarboxylic-acid, 1 [for example,], and 5-naphthalene dicarboxylic acid, etc. When the melt viscosity at the time of fabrication and the mechanical property after fabrication are taken into consideration, as for the relative viscosity (96% sulfuric-acid solution 1g/100mL) of the copolymerization polyamide used by this invention, it is desirable that it is 1.5-4.0.

[Translation done.]